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Abstract of **GB1022585**

A liquid plastisol composition suitable for preparing a foamed coating by applying it to a surface and heating consists essentially of (a) 100 parts by weight of polyvinyl chloride, (b) between 50 parts and 125 parts by weight of plasticizer, between 25% and 90% by weight of the total amount of plasticizer being a secondary petroleum derived plasticizer, and (c) between 1 part and 20 parts by weight of a blowing agent chosen from sodium carbonate and bicarbonate, ammonium carbonate, potassium carbonate and bicarbonate, and urea. The composition may also contain fillers, heat stabilizer and flame retardants such as antimony oxide.ALSO:Foamed coatings are prepared by applying to a surface a liquid plastisol composition consisting essentially of (a) 100 parts by weight of polyvinyl chloride, (b) between 50 parts and 125 parts by weight of plasticizer, between 25% and 90% by weight of the total amount of plasticizer being a secondary petroleum derived plasticizer, and (c) between 1 part and 20 parts by weight of a blowing agent chosen from sodium carbonate and bicarbonate, ammonium carbonate, potassium carbonate and bicarbonate, and urea, heating the coated surface until the fusion temperature is reached and then cooling. The coated surface is preferably a metal surface and the compositions may be applied by spraying, dipping, knife spreading, roller coating, brushing or by cascading upon the surface.

Description of **GB1022585**

COMPLETE SPECIFICATION.
Improvements in or relating to Liquid Plastisol Compositions.

We, M & T CHEMICALS INC., a corporation organized and existing under the laws of the State of Delaware, with executive offices at 100 Park Avenue, New York 17,
New York, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the followingstatement:
The present invention is directed to the production of novel foamed plastisol coatings and to liquid plastisol compositions therefor.

Foamed plastics are widely used because of their unique properties and/or because the foamed material serves the same function as solid material in a more economical manner. Foamed materials have been relatively expensive. A need exists for low cost foamed materials suitable for use in packaging. Such materials must, in addition to being of low cost, have sufficient bulk and strength to protect the article they buffer and/or encapsulate. These materials also must have sufficient tensile strength so that they can be easily stripped from the coated surface.

It is a primary object of this invention to provide economical methods of coating surfaces with foamed plastics.

We discovered that novel foamed plastisol coatings particularly useful for packaging objects with a thin inexpensive film of foamed coating having good physical charac
teristics can be prepared by applying a liquid composition containing polyvinyl chloride resin, a blend of plasticizers, an inorganic blowing agent such as sodium bicarbonate, and preferably a heat stabilizer and a filler. Additional additives such as viscosity control agents, pigments, flame retarding materials, may be used, dependent upon the desired properties of the foamed coating. The foamed coating can be produced by applying the liquid plastisol composition to the surface being coated and heating to the fusion temperature. Although foamed coatings as thick as100--125 mils may be desired for particular rugged packaging, most areas of our thin foamed coatings for packaging lighter material will be films having a thickness of between 5 and 20 mils. Foamed coatings for encapsulating small chromium plated parts and equivalent hardware, having a thickness of between 7 and 12 mils are particularly desired at the present. Dependent upon the liquid plastisol composition utilized, the foamed film may be between12 and 3 times, and usually between 2 and21 times, the thickness of the liquid coating applied to the surface.

According to this invention we provide a process for preparing a foamed coating comprising applying to a surface a liquid plastisol composition consisting essentially of
(a) 100 parts by weight of polyvinyl chloride resin;
(b) between 50 parts and 125 parts by weight of plasticizer, between25% and90% WO by weight of the total amount of plasticizer being a secondary petroleum derived plasticizer; and
(c) Between 1 part and 20 parts by weight of a blowing agent chosen from sodium carbonate, sodium bicarbonate, ammonium carbonate, potassium carbonate, potassium bicarbonate, and urea, and heating the coated surface until the fusion temperature is reached and then cooling.

We also provide in accordance with this invention a liquid plastisol composition suitable for preparing foamed coatings consisting essentially of:
(a) 100 parts by weight of polyvinyl chloride resin;
(b) between 50 parts and 125 parts by weight of plasticizer,between 25:/, and 90% by weight the total amount of plasticizer being a secondary petroleum derived plasticizer;
(c) between 1 part and 20 parts by weight of a blowing agent chosen from sodium carbonate, sodium bicarbonate, ammonium carbonate, potassium carbonate, potassium bicarbonate, and urea,
(d) up to 50 parts by weight of an inert filler; and
(e) between 0.75 part and 10 parts of heat stabilizer.

The foamed coatings are generally prepared from plastisol compositions containing polyvinyl chloride resins having a relativelythigh molecular weight of the type conventionally utilized in plastisolcomposi- tions. These are often referred to asdisner- sion type paste resins. The dispersiontvne resins are relatively expensive and may he partially replaced with the less expensive, more soluble "blending resins", also referred to as

"extender resins". These generally have a lower molecular weight than the dis- persion type resins. For instance up to 65% by weight and preferably between45 .) and 55% of the total weight of the polyvinyl chloride resin in a plastisol may be of this blending type.

The plastisol formulations described herein are formulated on the basis of the parts by weight of the specified componentw3e-.- hundred parts of thepolyvinyl chlorideresin(s).

The plasticizers applicable in preparing the liquid plastisol compositions of the pres- ent invention are those applicable in plastisol compositions. These include those referred to as "primary plasticizers", as illustrated by the phthalate esters such as dioctyl phthalate, dihexyl phthalate, and butyl(2-ethylhexivl) phthalate; the ester. s of straight chain dibasic acids such asdioctyl sebacate, and di-2-ethylhexyladipate: the phosphate esters such as tributyl and tricresyl phosphate; and the polymericolasti- cizers such as epoxidizedSova bean oil and the polypropylene glycol sebacates and adipates. The polymeric plasticizers which often have high viscosities should be used with one of the other plasticizers having a lower viscosity so that the plastisol composition is liquid. In addition to the primary plasticizer, our compositions also contain at least95 Ó and preferably at least 45% byweight (based on total plasticizer content) of a secondary plasticizer. As much as 90% by weight of the primary plasticizer may be replaced with the seconary. These secondary plasticizers are referred to as "petroleum derived plasticizers".

These are generally refined still bottoms; usually from petroleum refining processes or from the residue of an alkylation process.

Illustrative secondaries include a highly aromatic petroleum distillate, butylated naphthalene, a refined petroleum base hydrocarbon, and the bottoms from the distillation of dodecylbenzene. The high boiling liquid aromatics are preferred; generally those having a boiling point higher than nonylbenzene. The total plasticizer content of the liquid plastisol composition should be between 50 and 125 parts by weight and preferably between 65 and 110 parts by weight.

Those inorganic blowing agents which decompose at, or preferably below the fusion temperature, are generally used. Inorganic blowing agents which decompose under the influence of other components of the plastisol e.g. acid, at the specifiedtem- peratures, may also be used. The preferredblowing agent is sodium bicarbonate. Other inorganic compounds viz. sodium carbonate, ammonium carbonate, potassium carbonate, potassium bicarbonate, may be used.

In plastisols destined to be foamed to encapsulating material, between 5 and 10 parts by weight of blowing agent give the best results consistent with the economics ivol--ed. Larger or smaller amounts (bt'veen 3 parts-20 parts by weight) give foams having less useful properties and/or more expensive materials.

The plastisolcomeositions will usually contain a heat stabilizer such as an organic salt of barium, cadmium or zinc such as bariumlaureate, cadmium oleate, zinc ethvlhexoate, barium butylbenzoate, (singly or preferably in mixtures). Theorganotin compounds such as dibutyltin dilaurate anddibutyltin dimercaptide are extremely effective stabilizers.although somewhat more expensive. Stabilization may also be effected by the less expensive inorganic stabilizers such as lead carbonate and sulfate. The stabilizers arelased in amounts between about 0.75 Dartbv weight and 10 parts by weightder,end;ng on the stabilizer and the degree of stabilization required.

The plastisol compositions also frequently include an inert filler such as calcium carbonate.maor.esum silicate (talc). or barium sulphate, in amounts up to 50 partsbv weight, although preferably only up to 35 parts by weight; and a pigment such as titanium dioxide or lead chromate (chrome yellow). A flame retarding material such an antimony oxide preferably in amounts between 10 parts to 30 parts by weight is incorporated in plastisols when flame-retardant properties are desired in the foamed product. Viscosity control agents such as aluminum stearate or finely divided silica which increase the viscosity, and surfactants which tend to lower the viscosity may also be included in the plastisol composition dependent upon the overall viscosity desired. The plastisol composition may contain acid(s) and/or equivalent acid-yielding materials. Illustrative of these are the metal salts of fatty acids and/or the free fatty acids. Many of these also function as stabilizers.

The plastisol compositions may be applied to the surface of various basis metals by a wide variety of means. This is often dictated by the equipment available, the size and shape of the piece to be coated, and the economics. Pieces which are to be entirely covered with the plastisol material may be sprayed or dipped; when the piece contains re-entrant surfaces, dipping is generally preferable to spraying.

Where only a portion of the total surface is to be coated, the part is either sprayed or otherwise covered by a stream or curtain of liquid cascadingunon the part. A stream or curtain of liquid is obtained by directing the coatingcomposition through an orifice, usually having an elongated or slot-like shape. Knife spreading, roller coating and brushing may also be used. Conventional sprayequipment including electrostatic spray equipment may be used for spraying.

The plastisolcomnosi.ions used to form the foamed coatings as aforesaid have liquid flow characteristics. They are dispersions of solid polyvinyl chloride resin in the liqu plasticizer. When the plastisolcomnositi is referred to herein as a "liquid", it defines these dispersions. When the liquid coating is applied to the surface and heated the dispersed polyvinyl chloride resin particles dissolve in the plasticizer until at the fusiontemnerature a homogeneous composition is formed. With currently available plastisols, the fusion temperatures are generally between 320 F and 375 F and most often between 340 F and 360 F. The precise temperature requisite for complete fusion is also partially dependent upon the rate of heating.

For the purpose of giving those skilled in the art a betterunderstanding of the present invention, the following illustrative examples are given; parts denoted therein are by weight:
EXAMPLE 1 Parts
PVC resin, dispersion type . ... 100 di-2-ethylhexylphthalate.. ... 55 refined petroleum distillate ... 45 calcium carbonate ... ... 25 barium-cadmium carboxylic" acid
stabilizer ... ... 6 titanium dioxide ... ... 5 antimony oxide ... ... 20 sodium bicarbonate 6
A layer 8 mils thick was spread on a metal surface and then heated to the fusion temperature and cooled. The film foamed during heating. The foamed film was about 20 mils thick. It was quite strong and easily stripped in one piece from the metal.

EXAMPLE 2
Parts
PVC resin
dispersion type 70
blending type ... . 30 di-2-ethylhexyl phthalate ... ... 45 alkyl-aromatic hydrocarbon (bottoms of distillate of dodecylbenzene) ... 55 diatomaceous earth ... ... 40 dibutyltin dimercaptide ... ... 4 sodium bicarbonate 9
A layer aboutW5 mils thick was spread on a metal surface and then heated to the fusion temperature and cooled. The film foamed during heating, resulting in a film about 12 mils thick which had a tensile strength of about 200lbs./sq.in. (TensileTest-ASTM D 412-61T). The film was easily stripped from the metal surface.

EXAMPLE 3
Parts
PVC resin
dispersion type ... ... 60 blending type ... . 40 di-2-ethylhexyl phthalate ... ... 15 highly aromatic petroleum distillate
(high boiling) ... ... 75 calcium carbonate ... ... 20 lead carbonate ... . 4 antimony oxide ... ... 10 sodium bicarbonate 5
A layer about 3 mils thick was sprayed on a metal surface and then heated to the fusion temperature and cooled. The film foamed during heating. The resultant foamed coating was about 7 mils thick.

It had a tensile strength of about 200 lbs./ sq.in. and was easily stripped from the metal surface.

EXAMPLE 4
Parts
PVC resin, dispersion type ... ... 100 butylhexyl phthalate ... ... 60 butylated naphthalene ... ... 25 magnesium silicate ... ... 10 lead sulphate ... ... 5 carbon black ... . 1 sodium bicarbonate 8
A layer about 25 mils thick was spread on a metal surface, and then heated to fusion temperature and cooled. The film foamed during heating The resultant foamed coating was about70-75 mils thick. It was a very strong and durable film which was easily stripped from the metal surface.

Similar foamed coatings were prepared from plastisol compositions utilizing each of the other inorganic blowing agents specified hereinbefore in place of the sodium bicarbonate. The surfaces coated may be

metallic or non-metallic. The desired foamed coatings should have sufficient strength so that they can be stripped from the coated surface without shredding. They should not have overall strong adhesion to the surface.

Foamed coatings prepared from the plastisol compositions specified meet these requirements. They have tensile strengths in excess of 150 lbs./sq.in. Although the foamed coatings prepared from compositions have relatively high plasticizer content, there is little or no exuding of the plasticizer. The foamed coatings are economical; they are pleasing in appearance and serve to protect the coated surfaces. Although the liquid plasticol compositions are primarily useful for preparing foamed coatings for packaging purposes, they may be used to prepare similar foamed coatings for other purposes.

Claims of **GB1022585**

WHAT WE CLAIM IS:

1. A process for preparing a foamed coating comprising applying to a surface a liquid plastisol composition consisting essentially of
(a) 100 parts by weight of polyvinyl chloride resin;
(b) between 50 parts and 125 parts by weight of plasticizer, between25 ,h and 90% by weight of the total amount of plasticizer being a secon dary petroleum derived plasticizer; and
(c) between 1 part and 20 parts by weight of a blowing agent chosen from sodium carbonate, sodium bi carbonate, ammonium carbonate, potassium carbonate, potassium bi carbonate, and urea, and heating the coated surface until the fusion temperature is reached and then cooling.

2. The process according to Claim 1, wherein the liquid plastisol comnosition also contains up to 50 parts by weight of a filler and between 0.75 parts and 10 parts by weight of a heat stabilizer.

3. The process according to Claim 1 or Claim 2, wherein the liquid plastisol composition also contains between 10 parts and 30 parts by weight of antimony oxide.

4. The process according to any preceding claim, wherein the liquid plastisol is applied to the surface by spraying.

5. The process according to any one of Claims 1 to 3, wherein the liquid plastisol is applied to the surface by cascading upon the surface.

6. A process for preparing a foamed coating substantially as herein described and exemplified.

7. A coated surface whenever obtained by the process claimed in any preceding claim.

8. An article having the coated surface of Claim 7.

9. A liquid plastisol composition suitable for preparing foamed coatings consisting essentially of:
(a) 100 parts by weight of polyvinyl chloride resin;
(b) between 50 parts and 125 parts by weight of plasticizer, between 25% and90its by weight of the total amount of plasticizer being a second dary petroleum derived plasticizer;
(c) between 1 part and 20 parts by weight of a blowing agent chosen from sodium carbonate, sodium bi carbonate, ammonium carbonate, potassium carbonate, potassium bi carbonate, and urea,
(d) up to 50 parts by weight of an inert filler; and
(e) between 0.75 parts and 10 parts of a heat stabilizer.

10. A liquid plastisol composition suitable for preparing foamed coatings consisting essentially of:

(a) 100 parts by weight of polyvinyl chloride resin, at least 45 parts by weight being dispersion type paste resin and the remainder being blend ing resin;
(b) between 65 parts and 110 parts by weight of plasticizer, between 45% and 90% by weight of the total amount of plasticizer being a secon dary petroleum derived plasticizer;
(c) between 5 parts and 10 parts by weight of a blowing agent chosen from sodium carbonate, sodium bi carbonate, ammonium carbonate, potassium carbonate, potassium bi carbonate, and urea,
(d) up to 35 parts by weight of an inert filler;
(e) between 0.75 parts and 10 parts by weight of a heat stabilizer; and
(f) between 10 parts and 30 parts by weight of antimony oxide.

11. The composition of Claim 9 or Claim 10, which also contains a pigment.

12. The composition of any one of Claims 9 to 11, which also contains viscosity control agents.

13. The composition of any one of Claims 9 to 12, wherein the blowing agent is sodium bicarbonate.

14. The composition of any one of Claims 9 to 12, wherein the blowing agent is urea.

15. The composition of any one of Claims 9 to 14, wherein the secondary plasticizer is a highly aromatic petroleum distillate.

16. The composition of any one of claims 9 to 14, wherein the secondary plasticizer is a residue from the distillation of an alkylating process.

17. A liquid plastisol composition suitable for preparing foamed coatings substantially as herein described and exemplified.
